

Claims

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1. A reference mark detector for use with a metrological scale or encoder having a patterned reference mark movable relative to the reference mark detector the detector comprising a detector array for detecting the patterned reference mark, the detector array comprising at least two sets of detector elements each set being formed as a pattern which relates to the pattern of the reference mark.
 - 15 2. A reference mark detector as claimed in claim 1 wherein each element of each set has an output, each of the outputs from each of the elements of a set is summed with the other elements of the same set, and the summed output from a second of the sets is subtracted from the summed output of a first of the sets.
 - 20 3. A reference mark detector as claimed in claim 2 wherein the pattern of the first and second set of detectors is irregular.
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4. A reference mark detector as claimed in any one of claims 1 to 3, wherein the detector array comprises two rows of elements, the first of the rows containing a first one of the sets of detector elements and the second row containing a second one of the sets of detector elements.
 - 30 5. A reference mark detector as claimed in claim 4 wherein the first of the rows is displaced relative to

the second of the rows in a direction of movement of the reference mark detector relative to the reference mark in use.

5 6. A reference mark detector as claimed in claim 1,2 or
3 wherein the detector array comprises a single row, a
first set of detector elements and a second set of
detector elements comprising detector elements in the
row.

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7. A reference mark detector as claimed in claim 6
wherein the first set of detector elements are
connected together to provide a distinct output when
the reference mark is detected in a first position and
15 the second set are connected together to provide a
distinct output when the reference mark is detected at
a position different to the first position.

8. A reference mark detector as claimed in claim 7
20 wherein the position of the first and second set of
detector elements correspond to positions in a notional
table, the first row of the table containing high or
low values corresponding to the pattern of the
reference mark, the second row of the table containing
25 the same values, the values in the second row being
displaced relative to the position in the table of the
values of the first row in the direction of the rows,
each value from the second row being deducted from the
values of the first row immediately above the values of
30 the second row to form a resultant for each position in
the table, the position in the table of the positive
high values of each resultant representing the
positions of the first set of detector elements and the
positions in the table of the negative high values of

each resultant representing the positions of second set of detector elements.

9. A reference mark detector as claimed in any one of
5 the preceding claims 3 to 8 when dependent on claim 2
wherein the summing of the outputs and the subtraction
of the sums is done digitally.

10. A metrological scale or encoder having periodic
markings for incremental measurement operations and a
scale reader for determining the displacement of the
reader relative to the scale by reading the periodic
markings, the scale including a patterned reference
mark, the scale reader including a reference mark
15 detector including a detector array, the array
comprising at least two sets of detector elements, each
set having separately processed outputs and including
means for producing a signal from the outputs of the
elements having a value which crosses zero when the
20 reference mark is detected by the reference mark
detector.

11. A metrological scale or encoder as claimed in claim
10 wherein the means for producing the signal includes
25 summing the outputs of each of the elements in a first
set of the said at least two sets to produce a first
summed output and summing the output from a second set
of the said at least two sets to produce a second
summed output, then subtracting the second summed
30 output from the first summed output.

12. A metrological scale or encoder as claimed in claim
10 wherein the array is formed as at least two rows
and a first one of the said sets is included in one of

the rows, and a second set is included in an other of the two rows.

13. A metrological scale or encoder as claimed in claim
5 10 wherein the array is formed as a single row and a first and second set of sets of elements are comprised in the single row.

14. A metrological scale as claimed in any one of
10 claims 10 to 13 wherein the reference mark comprises bits missing or added to the periodic markings of the scale or encoder.